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MOSQUITO CONTROL ABOUT CANTONMENTS AND SHIPYARDS.

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When military cantonments were being established during 1917 and 1918 it was realized that it would be insufficient to protect the health of soldiers, sailors, and skilled laborers within the boundary lines of cantonment or industrial plants only, as previous history of sanitation indicates that disease is contracted in municipal and rural areas lacking proper sanitation more frequently than in naval and military reservations having proper facilities for medical and sanitary control. The records of medical and sanitary officers show this to be particularly true of malaria.

As the records of our camps during the Civil and Spanish-American Wars indicated that large numbers of enlisted men were rendered unfit for service after contracting malaria, it was deemed essential to institute malaria campaigns at locations near military cantonments, naval reservations, aviation camps, munition plants, ship-construction yards, and other important war industries. It was realized that the introduction of large forces of labor from malaria-infested regions would produce new conditions at and near cantonment towns that would make extra precautionary measures essential; also that special attention must be devoted to all places where war-industry employees, as well as Army and Navy men, congregated or remained after sundown in potentially malarial districts. There were strong indications of a future shortage of both skilled and unskilled labor, and it was evident that unless precautions were taken to protect these men at their homes, the labor situation would become more serious. There was little danger of malaria being contracted within the cantonment reservations, as the sanitary corps of our Army were prepared to care for these areas, but, as the laborers and many enlisted men were likely to be in the cantonment town and its suburbs after dark, the protective measures were necessary for both classes of men. The important problem then was to do thorough work rapidly in all localities where Navy, Army, and war industry employees were present in numbers after sundown in potentially malarial districts, as well as to prevent mosquitoes from flying into the reservations. In the selection of camp sites, the question of malaria prevalence and control of future epidemics was apparently only one of many requirements to be considered, and, as it was essential to expedite camp construction with all possible speed, the preventive malaria measures had to proceed accordingly.

It was not known in advance how many camps were to be established, when or where they were to be located, nor what force of trained engineers, foremen, and labor would be needed; but it was very apparent that as soon as each camp site was approved, mosquito-control measures and drainage operations should be expedited in order to head off malaria transmission in that locality. The shortage of efficient labor and the necessity of obtaining funds that could be applied immediately were very important items. In some cases it was an extremely difficult and slow process to convince the local authorities of the urgent necessity of appropriating necessary funds immediately and valuable time was lost, but as a whole the support given by the town and county authorities of the Southern States has been very encouraging. It is gratifying to note the strong and immediate financial support given to protection of health of our enlisted men by the Chamber of Commerce of Little Rock and all cantonment towns in Mississippi. The mayor and city authorities of Jackson, Miss., decided to institute a malaria campaign whether their proposed camp site was accepted or not and have carried on an active and efficient campaign that is a credit to that town and the State. It was most unfortunate that their example was not followed by administrative officers in other localities and States where the efficiency of the citizens could thereby have been increased at the time when the Nation was calling on all patriotic citizens to do their utmost.

The malaria and sanitary control measures instituted along the Mississippi Gulf coast from Biloxi to Pass Christian, and the solid financial support given by the local and county authorities there have rapidly made that area practically free from malaria transmission, and the local advantages of that residential area will soon be more apparent to the public at large. It is now the longest known stretch of our southern seacoast practically free from the malaria-conveying mosquito, and without doubt this far-sighted, progressive, and patriotic policy will soon pay well as a financial investment, as it has done in many instances elsewhere.

Local Drainage Problems.

In the environment of some cantonments and war industry towns the drainage problems have been simple and consisted largely of rechanneling existing watercourses and of pond control. At others large ditches were necessary and steam shovels were used. In some cases it was found more economical to install ditches by the use of dynamite.

Wilmington, N. C., had an unusual problem. Close to and even within the town limits were extensive, abandoned rice fields subject to overflow and generally wet. It was necessary to repair or reconstruct dikes and to use tidal gates to prevent mosquito breeding; also a large shallow lake with about 6 miles of shore line is within flight range of both the shipyards located there.

Chattanooga, Tenn., eliminated some former Anopheles' breeding areas by draining ponds to holes dug in the limestone formation where the water was absorbed; also the mosquito breeding in the large spring and lake near Camp Oglethorpe was controlled by using a subaqueous saw to remove the aquatic vegetation that furnished protection for Anopheles larvæ.

At Nashville, Tenn., the stream beds are largely composed of limestone. Where such formation can be economically channeled the cross section of the drainage courses can be largely reduced and oil spraying thereby made less expensive. Where the limestone is hard, it is less costly to clear the stream beds of obstructions and rely on oiling for control.

Near Macon, Ga., were six lakes and a large heavily wooded swampy area with soft silt bottom. Its feeder stream was diverted to the Ocmulgee River by means of a steam-shovel-dug ditch. Ditches were extended into the main swamp, which was several miles long and had but little grade. After deepening these ditches to a certain point, the pressure of the banks would cause the bottom of the ditch to rise. Saplings were used and laid parallel to the banks as a ditch lining or wall to support the banks. Stakes were driven to hold the saplings in place and were then fastened back to living stumps or trees close to the ditch. Later, as the banks dried, the ditch was deepened. The banks became solid and the bottom held to grade. As the silt and mud in this swamp area were too soft to dig to advantage, a large part of the ditching was done by dynamite. Several weeks after the swamp was drained its bottom became very hard. In installing some of the ditches the semiliquid mud was so soft it could be bailed out. Before this work was started we were informed by the local authorities that the project was impossible and had a difficult time obtaining funds for its accomplishment.

The problem near the aviation field at Millington, Tenn., was the removal of drift in several miles of a deep creek bed with low grade. Many of the collections of drift and log jams were 6 to 12 feet high, 50,100 or more feet long, and contained many fallen trees and logs 3 feet or more in diameter. It was expensive, slow, and tedious work.

Near the town of Americus, Ga., Muckalee Creek had to have its center line straightened and years of collection of fallen trees and logs removed in order to keep water off the flat lands adjacent to its banks. During operations a cyclone traveled up the creek bed and increased existing troubles.

Surrounding the cantonment at Jacksonville, Fla., is a sandy formation that will stand only on a very flat slope. The ditching there was made difficult by the presence of the roots of a palm plant.

These roots are about as thick as one's arm and from them radiate smaller roots located close together and these make the removal of the main root expensive. A large part of the ditching work there was done by dynamite. Also in that locality a branch of the St. John River contains much tightly packed water hyacinth which had to be removed.

In the vicinity of Montgomery, Ala., a large part of the ditching was accomplished by means of a ditching plow drawn by two mules. Mile after mile of ditch was thus installed at a cost of about $55 per mile. The topography is fairly flat and the soil suitable for this means of ditching. Also some ponds and wet places were drained to a porous gravel substratum. The vertical drain holes were kept from silting up by means of screen entry boxes.

Surrounding the cantonment at Hattiesburg, Miss., are sandy hills, but in the ravines are narrow areas of wet, silt-like formation 6 to 10 feet deep, penetrated by heavy masses of large roots. It was found too slow and expensive to excavate ditches by handwork in such places, but drainage was accomplished by blasting center ditches and installing side seepage ditches where necessary.

In the Gulfport, Miss., area are a series of hollows parallel to the Gulf shore line. In some places nine such parallel water-holding depressions occur within one mile of the shore line. Most of the swamps contain a heavy root growth and have but little grade, so wide bottom ditches have to be used, as the ditches are long and the possible permanent outlets few in number.

At some of the areas in Texas, mosquito breeding is confined to storm-water ravines which contain many pot holes, the only source of water supply for the cattle in many instances. The reduction of the number of holes and the deepening of the remaining ones to prevent their rapid drying was one method of control.

Near Camp Pike, Ark., some of the stream beds contain large bowlders, which made draining of the streams expensive. At the aviation field in Arkansas, as well as at Lake Charles, La., rice fields, which are probably the most prolific sources of Anopheles, were located within flight range of the cantonments.

At most of the camps construction work was in progress, or troops were present, when malaria work was started; so, to a large extent, temporary measures were used at first, and permanent work done as rapidly and more or less thoroughly as conditions would allow in order to get as much quick relief as possible. This work was accompanied or followed by complete drainage of areas within flight range of districts to be protected.

In order to get an immediate mosquito control in the Hog Island Shipyard district many acres of cat-tail growth had to be cut down and kept under oil control until the ditching systems were established. This was necessary also in other districts.

Excellent results were accomplished by the Army Sanitary Corps within the military reservations. Most cordial relations existed between the officers of that corps (whose duty it was to prevent mosquito production within the military cantonment) and the officers of the United States Public Health Service, who directed similar measures on a strip of land one mile wide surrounding each cantonment in the cantonment town, and in an area about a mile wide surrounding the town. In addition, it was frequently necessary to undertake similar control operations at distant amusement parks and in additional areas where enlisted men and war-industry employees congregated.

Results Accomplished.

It was not possible to get rid of all Anopheles immediately, as camps were established in rapid succession in widely separated areas ranging from New Jersey to Texas, and Memphis, Tenn., to Jacksonville, Fla. Successful malaria control work was carried out in 43 separate areas in 15 States (in addition to the cantonment areas themselves). Anopheles control has been accomplished in a total area of over 1,200 square miles. Where cantonments have been located in notoriously malarial sections very little malaria has been contracted by enlisted men, and the malaria sick rate among enlisted men in camp has been very much lower than it would have been had they stayed at home. The commanding medical officers at the cantonments report mosquitoes as being scarce at nearly all camps, and Anopheles, seldom seen, except at two of the aviation camps near rice-field areas. When the Army and Navy cantonment sick rate figures are published it will undoubtedly be shown that, due to proper mosquito-control measures, practically very little, and, in many instances, no malaria has been contracted at camps located in regions noted for malaria.

At some of the extra-cantonment areas this work has now been going on for two seasons, and many prominent local physicians have informed me that there has been a remarkable reduction in the malaria sick rate of the civil population in and near their cantonment towns. This demonstration work, distributed over a wide area, has protected a civil population of about 1,750,000, and an average, constantly changing, military and naval population of 800,000, and should lead to a better and more extended general campaign. Drainage and mosquito control work has been accomplished in and near the following cantonment cities, towns, and villages:

Alabama: Sheffield, Tuscumbia, Florence, Anniston, Montgomery.
Arkansas: Little Rock, Lonoke.
Florida: Jacksonville.

Georgia: Macon, Augusta, Atlanta, Columbus, Americus.
Kentucky: Louisville.
Louisiana: Lake Charles, Alexandria.
Mississippi: Biloxi, Gulfport, Pass Christian, West Point, Hattiesburg, Jackson.
North Carolina: Charlotte, Raleigh, Fayetteville, Wilmington.
South Carolina: Columbia, Greenville, Spartanburg, Charleston.
Tennessee: Memphis, Millington, Nashville, Chattanooga.
Texas: Dallas, Fort Worth, Houston, San Antonio, Orange.
Virginia: Newport News, Petersburg, Alexandria, Portsmouth, Quantico.

These towns, as well as the counties in which they are located, contributed liberally toward mosquito-control measures in order to protect our military forces and make camp life pleasant for our sailors and soldiers.

The railroad corporations gave strong support and willingly did such drainage work as was requested. The local communities paid over one-third of the total cost of the work in addition to large sums for other sanitary measures. The cost of drainage, oiling, supervision, equipment, and transportation averaged about $1.80 per acre of territory controlled.

The support given by the public of the South and the officials who represent them, even in relatively poor and sparsely settled districts, and results accomplished there, stand out in strong contrast with conditions yet existing in the environment of some of the New York camps, where, beyond the military cantonment lines, no mosquito-control measures were inaugurated. Many of the sentries on night duty at our southern camps have told me they very seldom noticed mosquitoes there. The real-estate values close to the south shore towns near Camp Upton can be doubled by an expenditure of about $12 per acre on the brackish marshes near by, but the fact is apparently not yet appreciated by the property owners and real-estate interests.

Approximately half of the cantonment towns of the South have planned to continue mosquito-control measures, and there are yet others to be heard from. Among other benefits that the war has brought is a tremendous advance in general sanitation in many southern towns and an equally important one in Anopheles and malaria control.

Corporations establishing branch houses, new industries, and developing natural resources in some States are fully aware that an absence of mosquitoes has an important bearing on the availability and efficiency of skilled and unskilled labor as well as on the proper development of real-estate values. The local chambers of commerce and the press now appreciate the other commercial advantages that follow mosquito eradication measures.

In certain instances where the town officials were under the impression that the expense of a mosquito drainage campaign would be beyond their financial ability, they were astounded to discover that the annual cost of screening houses and screen repairs greatly exceeded the cost of mosquito elimination. They did not realize the fact that it often costs a community, and the citizens of it personally, much more to support a mosquito nuisance than to eliminate it.

The president of a large association of cotton-mill interests has stated that the elimination of mosquitoes near the mill properties has paid a higher return on the money expended than any other investment that the corporation has ever made.

Publications Relating to Malaria, Mosquitoes, and Mosquito Control.

PUBLIC HEALTH BULLETINS.

79. Impounded Water. Surveys in Alabama and South Carolina During 1915 to Determine Its Effect on Prevalence of Malaria. By H. R. Carter, J. A. A. Le Prince, and T. H. D. Griffitts. 1916.

84. Is Mosquito or Man the Winter Carrier of Malaria Organisms? By M. Bruin Mitzmain. December, 1916.

88. Malaria Control: A Report of Demonstration Studies Conducted in Urban and Rural Sections. By R. C. Derivaux, H. A. Taylor, and T. D. Haas.

REPRINTS FROM THE PUBLIC HEALTH REPORTS.

28. Prevention and Destruction of Mosquitoes. By Joseph Goldberger. July 17, 1908.

105. Antimalarial Measures for Farmhouses and Plantations. By H. R. Carter. December 6, 1912.

156. Malaria in North Carolina. By H. R. Carter. December 19, 1913.

160. Malarial Fevers. Prevalence and Geographic Distribution in Arkansas. By R. H. von Ezdorf. January 2, 1914.

170. Prevention of Malaria. Suggestions on How to Screen the House to Keep Out Effectively the Mosquitoes Which Spread the Disease. By R. H. von Ezdorf. February 27, 1914.

172. Malarial Fevers. Prevalence and Geographic Distribution in South Carolina, Georgia, and Florida. By R. H. von Ezdorf. March 13, 1914.

180. Malarial Fevers in the United States. By R. H. von Ezdorf. April 10, 1914.

186. Malarial Fevers. Prevalence and Geographic Distribution in Alabama. By R. H. von Ezdorf. May 1, 1914.

193. Malarial Fever. Prevalence and Geographic Distribution in Mississippi, 1913. By R. H. von Ezdorf. May 22, 1914.

217. Mosquitoes and Malaria. Report on a Short Trip in Eastern North Carolina. By Ch. Wardell Stiles. September 4, 1914.

244. Impounded Water. Some General Considerations on its Effect on the Prevalence of Malaria. By H. R. Carter. December 25, 1914.

248. Impounded Waters. Their Effect on the Prevalence of Malaria. Survey at Blewetts Falls. By H. R. Carter. January 1, 1915.

257. Impounded Waters. A Study of Such Waters on the Coosa River in Shelby, Chilton, Talladega, and Coosa Counties, Ala., to Determine the Extent to Which They Affect the Production of Anophelines, and of the Particular Conditions Which Increase or Decrease Their Propagation. By J. A. A. Le Prince. February 12, 1915.

258. Malaria Control. Drainage as an Antimalarial Measure. By J. A. A. Le Prince. February 19, 1915.